Paper ID: 76848
oral
student

30th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Satellite Missions Global Technical Session (9-GTS.5)

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FOUR MONTHS TO ORBIT: FAST-TRACKING CUBESAT DEVELOPMENT FOR RELIABILITY THROUGH IN-ORBIT-DEMONSTRATIONS

Abstract

The EPFL Spacecraft Team is working on developing the CHESS (Constellation of High-Energy Swiss Satellites) mission, foreseen to launch in 2025; a constellation consisting of two 3U CubeSats to study the chemical composition of Earth's exosphere, using time-of-flight mass spectrometry.

This paper presents an innovative approach for developing reliable CubeSats by reducing subsystem risks through In-Orbit Demonstrations. The study focuses on the "Bunny Mission", a student-led initiative that successfully launched an onboard computer demonstrator as a hosted payload for in-situ tests in orbit as a precursor for the CHESS mission. The project was realized within an impressive four-month timeframe and launched via an orbital transfer vehicle to low Earth orbit in January 2023.

The high-value scientific payloads of the final CHESS mission introduce tight margins on the reliability of CubeSats, which present an inherent risk due to their low-cost implementations. The study demonstrates the ability of students to rapidly iterate on the design, verification, and integration of a space-grade payload within tight deadlines. The paper defines the architecture of the payload, examines the technical challenges encountered and presents a systems engineering approach for addressing these challenges. The study highlights the benefits of In-Orbit Demonstrations for risk reduction and its added educational value for students. This project serves as a testament to the ability of students to lead and contribute to the advancement of space technology, and the authors hope this paper will inspire other students to pursue similar projects and contribute to the growth and development of the space sector.